Problem 1:

a) Determine the matrices $U, \Sigma, V$ that make up the singular value decomposition, $A = U\Sigma V^T$, of the following matrices

$$A_1 = \begin{bmatrix} -1 & -1 & -1 & -1 \\ 1 & 1 & -1 & -1 \\ -1 & 1 & 1 & 0 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} -2 & 2 & 0 & -2 \\ 2 & -1 & 1 & 3 \\ 0 & 1 & 1 & 1 \\ -2 & 3 & 1 & -1 \end{bmatrix}$$

b) Use the results of a) to find, in each case, the rank of $A_i$, the norm $\|A_i\|$ and the basis for $\text{null}(A_i)$.

Computer Assignment 8:

a) Write a MATLAB function $[U,S,V]=svdsimp(A)$ that computes the singular value decomposition, $A = USV^T$, of an $m \times n$ matrix $A$. The output variables are the $m \times m$ orthogonal matrix $U$, the $m \times n$ diagonal matrix $S$, and the $n \times n$ orthogonal matrix $V$.

b) Use the function $svdsimp$ to calculate the singular value decomposition of the following matrix

$$A = \begin{bmatrix} -3 & 2 & 6 & -8 & 0 & 5 & 3 \\ 2 & -9 & 5 & 3 & 4 & 4 & 1 \\ 0 & 0 & 4 & 2 & -1 & -1 & -1 \\ 3 & 2 & 0 & -3 & -3 & 1 & 1 \\ 5 & 4 & 4 & 4 & 5 & 8 & 9 \end{bmatrix}$$